

FORM PTO-1390  
(REV 5-93)

U S DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

ATTORNEY'S DOCKET NUMBER

225/49355

U S APPLICATION NO (if known, see 37 CFR 1.5)

09/674852

**TRANSMITTAL LETTER TO THE UNITED STATES  
DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING  
A FILING UNDER 35 U.S.C. 371**

INTERNATIONAL APPLICATION NO.  
PCT/EP99/02989INTERNATIONAL FILING DATE  
3 May 1999PRIORITY DATE CLAIMED  
7 May 1998

## TITLE OF INVENTION

DEVICE FOR DETERMINING THE POSITION OR SIZE OF A HOLE

APPLICANT(S) FOR DO/EO/US  
Axel SCHAMAL

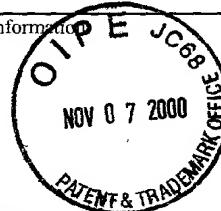
Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information.

1.  This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2.  This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3.  This express request to begin national examination procedures (35 U.S.C. 371(f) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1)).
4.  A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5.  A copy of the International Application as filed (35 U.S.C. 371(c)(2)).
  - a.  is transmitted herewith (required only if not transmitted by the International Bureau).
  - b.  has been transmitted by the International Bureau
  - c.  is not required, as the application was filed in the United States Receiving Office (RO/US)
6.  A translation of the International Application into English (35 U.S.C. 371(c)(2))
7.  Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
  - a.  are transmitted herewith (required only if not transmitted by the International Bureau).
  - b.  have been transmitted by the International Bureau.
  - c.  have not been made; however, the time limit for making such amendments has NOT expired.
  - d.  have not been made and will not be made.
8.  A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9.  An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)) (unexecuted).
10.  A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

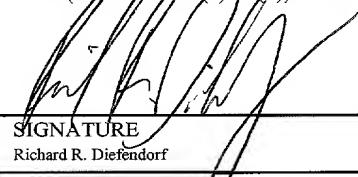
## Item 11. to 16. below concern other document(s) or information included:

11.  An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12.  An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13.  A **FIRST** preliminary amendment.
- A **SECOND** or **SUBSEQUENT** preliminary amendment.
14.  A substitute specification.
15.  A change of power of attorney and/or address letter.
16.  Other items or information:

Copies of (1) First page of int'l pub. no. WO 99/57504; (2) Request Form, PCT/RO/101 (4 pages); (3) International Search Report; (4) International Preliminary Examination Report; and (5) Form PCT/IB/308



526 Rec'd PCT/PTO 07NOV2000

U.S. APPLICATION NO (if known, see 37 CFR 1.5 <b>09/674852</b>		INTERNATIONAL APPLICATION NO PCT/EP99/02989	ATTORNEY'S DOCKET NUMBER 225/49355																	
17. [X] The following fees are submitted: Basic National Fee (37 CFR 1.492(a)(1)-(5)):		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">Search Report has been prepared by the EPO or JPO .....</td> <td style="width: 50%;">\$860.00</td> </tr> <tr> <td>International preliminary examination fee paid to USPTO (37 CFR 1.482) .....</td> <td>\$690.00</td> </tr> <tr> <td>No international preliminary examination fee paid to USPTO (37 CFR 1.482)</td> <td></td> </tr> <tr> <td>but international search fee paid to USPTO (37 CFR 1.445(a)(2) .....</td> <td>\$710.00</td> </tr> <tr> <td>Neither international preliminary examination fee (37 CFR 1.482) nor</td> <td></td> </tr> <tr> <td>international search fee (37CFR 1.445(a)(2) paid to USPTO .....</td> <td>\$1000.00</td> </tr> <tr> <td>International preliminary examination fee paid to USPTO (37 CFR 1.482)</td> <td></td> </tr> <tr> <td>and all claims satisfied provisions of PCT Article 33(2)-(4) .....</td> <td>\$100.00</td> </tr> </table>			Search Report has been prepared by the EPO or JPO .....	\$860.00	International preliminary examination fee paid to USPTO (37 CFR 1.482) .....	\$690.00	No international preliminary examination fee paid to USPTO (37 CFR 1.482)		but international search fee paid to USPTO (37 CFR 1.445(a)(2) .....	\$710.00	Neither international preliminary examination fee (37 CFR 1.482) nor		international search fee (37CFR 1.445(a)(2) paid to USPTO .....	\$1000.00	International preliminary examination fee paid to USPTO (37 CFR 1.482)		and all claims satisfied provisions of PCT Article 33(2)-(4) .....	\$100.00
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<b>ENTER APPROPRIATE BASIC FEE AMOUNT =</b>		<b>\$ 860.00</b>																		
Surcharge of \$130.00 for furnishing the oath or declaration later than [ ] 20 [X] 30		\$ 130.00																		
months from the earliest claimed priority date (37 CFR 1.492(e)).																				
Claims	Number Filed	Number Extra	Rate																	
Total Claims	10-20=	0	X \$18.00	\$ 0																
Independent Claims	2-3=	0	X \$80.00	\$ 0																
Multiple dependent claims(s) (if applicable)			+ \$270.00	\$ 0																
<b>TOTAL OF ABOVE CALCULATIONS =</b>		<b>\$ 990.00</b>																		
Reduction by ½ for filing by small entity, if applicable. Verified Small Entity statement must also be filed. (Note 37 CFR 1.9, 1.27, 1.28).		\$ 0																		
<b>SUBTOTAL =</b>		<b>\$ 990.00</b>																		
Processing fee of \$130.00 for furnishing the English translation later than [ ] 20 [ ] 30		\$ 0																		
months from the earliest claimed priority date (37 CFR 1.492(f)).		+																		
<b>TOTAL NATIONAL FEE =</b>		<b>\$ 990.00</b>																		
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28,3.31). \$40.00 per property +		\$ 0																		
<b>TOTAL FEE ENCLOSED =</b>		<b>\$ 990.00</b>																		
		Amount to be: \$																		
		refunded																		
		charged	\$																	
<p>a. [X] A check in the amount of <u>\$ 990.00</u> to cover the above fees is enclosed.</p> <p>b. [ ] Please charge my Deposit Account No. _____ in the amount of \$ _____ to cover the above fees. A duplicate copy of this sheet is enclosed.</p> <p>c. [X] The Commissioner is hereby authorized to charge any additional fees, which may be required, or credit any overpayment to Deposit Account No. <u>05-1323</u> (225/49355). A duplicate copy of this sheet is enclosed.</p> <p>NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.</p>																				
<p>SEND ALL CORRESPONDENCE TO:</p> <p>Evenson, McKeown, Edwards &amp; Lenahan, P.L.L.C. 1200 G Street, N.W., Suite 700 Washington, D.C. 20005 Tel. No. (202) 628-8800 Fax No. (202) 628-8844</p> <p>  <b>SIGNATURE</b>  Richard R. Diefendorf</p> <p>NAME 32,390</p> <p>REGISTRATION NUMBER November 7, 2000</p> <p>DATE</p>																				

09/674852  
526 Rec'd PCT/PTO 07NOV2000

Attorney Docket: 225/49355  
PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: AXEL SCHAMAL

Serial No.: Not Yet Assigned  
(PCT Appln. No. PCT/EP99/02989)

Filed: November 7, 2000  
(PCT Appln. Date: May 3, 1999)

Title: DEVICE FOR DETERMINING THE POSITION OR SIZE OF A HOLE

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents  
Washington, D.C. 20231

Sir:

Kindly make the following amendments prior to examination of this application.

Please substitute the abstract of the disclosure attached as Appendix I to this preliminary amendment for the abstract appearing on page 8 of the translation.

Please replace pages 1-5 of the translation with the substitute specification attached as Appendix II to this preliminary amendment.

Please amend claims 1-7 of the translation as follows:

1. (Amended) Device for determining the position of or for measuring a hole in a component, in particular a body part of a motor vehicle, [having] comprising:

a spike [(1)] for fitting into the hole, and  
an attachment element [(2)] which can be connected releasably to the spike [(1)] and, with the spike [(1)] fitted into the hole, rests on the component surface surrounding the hole,

[characterized in that] wherein at least part of the attachment element [(2)] is produced from a magnetic material.

2. (Amended) Device according to Claim 1, [characterized in that] wherein the attachment element [(2)] has an essentially hemispherical or partially spherical shell [(3)] made of a

non-magnetic material and an insert [(4)] arranged within the shell [(3)] and made of magnetic material.

3. (Amended) Device according to Claim 2, [characterized in that] wherein the spike [(1)] can be screwed to the attachment element [(2)].

4. (Amended) Device according to Claim 3, [characterized in that] wherein the spike [(1)] has an upper part [(1a)] which is designed with a screw thread, can be passed through the insert [(4)] and can be screwed to the inside of the shell [(3)].

5. (Amended) Device according to [one of the preceding claims, characterized in that] Claim 1, wherein the spike [(1)] can be fastened to the attachment element [(2)] in an asymmetrical manner with respect thereto.

6. (Amended) Attachment element for a device for determining the position of or for measuring a hole[, having means for the releasable connection] which is releasably connectable to a spike [(1)] which can be fitted into the hole, [characterized in that] at least part of the [said] attachment element [is] being produced from a magnetic material.

7. (Amended) Attachment element according to Claim 6, [characterized in that it has] comprising an essentially hemispherical or partially spherical shell [(3)] made of a non-magnetic material and an insert [(4)] arranged within the shell [(3)] and made of a magnetic material.

Please add the following new claims:

--8. Device according to Claim 2, wherein the spike can be fastened to the attachment element in an asymmetrical manner with respect thereto.

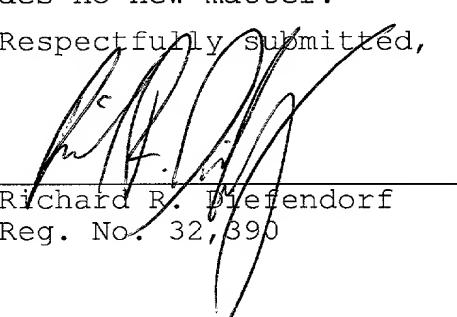
9. Device according to Claim 3, wherein the spike can be fastened to the attachment element in an asymmetrical manner with respect thereto.

10. Device according to Claim 4, wherein the spike can be fastened to the attachment element in an asymmetrical manner with respect thereto.--

REMARKS

This Preliminary Amendment is being filed to improve the form of this application for examination in the U.S. Patent and Trademark Office. A marked-up copy of the substitute specification referred to above, showing added material by underlining and deleted material between brackets, is attached to this Preliminary specification as Appendix III. The substitute specification includes no new matter.

Respectfully submitted,

  
Richard R. Diefendorf  
Reg. No. 32,890

November 7, 2000

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Abstract

## APPENDIX I

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Substitute specification

## APPENDIX II

DEVICE FOR DETERMINING THE POSITION OR SIZE OF A HOLE

5 BACKGROUND AND SUMMARY OF THE INVENTION

The present invention relates to a device for determining the position of or for measuring a hole, and to an attachment element.

10 In numerous technical applications it is necessary, in order to measure a component, to determine the precise positions of or distances between a number of holes formed in the component. For example, in the sphere of using measuring techniques to check body shells and 15 also subgroups thereof, for example sheet-metal add-on parts or else individual parts, measurements of this type have to be carried out frequently. A difficulty here is that the holes or the central points thereof are not accessible directly and so precise measurements turn out 20 to be very complicated. Furthermore, the dimensions of holes are frequently affected by tolerances and so it is expedient to determine the central points of holes.

DE-C 936895 discloses a device for measuring distances on an object, which device is inserted into a 25 hole in the object to be measured. The device consists of two separate parts, namely a shank for fitting into the hole in the object, and a part which ends in a ball of a certain radius of curvature. This ball can be positioned in such a manner that it serves as reference point with 30 respect to the central point of the hole. A disadvantage of this device is that it is not possible to use this device to undertake a measurement at inaccessible locations, for example on a floor panel of a motor vehicle body, since the device does not have any means 35 for fixing it so as to undertake precise measurements in the hole to be measured.

DE-C 733 370 discloses a means for measuring distances of connecting points, in particular points which cannot be measured directly, such as ball centres, 40 the said means consisting of a main measuring rod having longitudinally adjustable sliding bodies and measuring elements which can be displaced therein transversely to the main measuring rod. This means which is of

comparatively large construction is not suitable for undertaking measurements at inaccessible locations.

5 German utility model G 91 06 101 discloses a precision measuring rod which, by inserting a spike into an opening, permits the diameter of the opening to be measured. The precise determination of the position of the opening is not the subject matter of the teaching described in this publication.

10 The object of the invention is the provision of a device with which a determination of the position of or measurement of inaccessible holes or recesses in a component is possible in a simple manner.

15 The invention provides a device with which the precise determination of the position of holes or recesses, for example in a body of a motor vehicle, can be carried out in a simple manner. The formation of at least part of the attachment element from a magnetic material enables the device according to the invention to be simply and reliably fixed on a component, which 20 facilitates the carrying-out of very precise measurements. Measurements can also be carried out without any problem at inaccessible locations, for example the floor panel of a motor vehicle body, since the device according to the invention can be inserted, 25 for example from below, into a hole in the floor panel and can be fixed in the inserted position without further auxiliary means. The device according to the invention can be produced very reasonably. A particular advantage is the mounting of at least one attachment element 30 together with a multiplicity of spikes in a jig. In this case, all of the spikes required for measuring a body together with an attachment element which can be used with all of the spikes can be provided in an easily surveyed manner.

35 Of course, protection is sought for the attachment element which can be used in such a manner like an adapter and into which spikes of any design can be inserted.

40 According to a preferred refinement of the device according to the invention, the attachment element has an essentially hemispherical or partially spherical shell made of a non-magnetic material, and an insert arranged within the shell and made of a magnetic material. At the

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insert use can be made, for example, of a conventional magnetic flat gripper which can be fixed in a simple and positionally precise manner in a shell made, for example, of aluminium.

5        The spike can expediently be screwed to the attachment element. This firstly makes precise positioning of the spike in the attachment element possible, but secondly also enables the two parts to be detached from one another in an uncomplicated manner,  
10      with the result that one attachment element can be used for a multiplicity of spikes.

According to a preferred refinement of the device according to the invention, the spike has an upper part which is designed with a screw thread, can be passed 15 through the insert and can be screwed to the inside of the shell. This enables the insert to first of all be positioned and/or fixed in a precisely fitting manner in the shell, as a result of which the attachment part composed in such a manner can be used in an adapter-like 20 manner together with a multiplicity of spikes.

According to a further preferred refinement of the device according to the invention, the spike can be fastened to the attachment element in an asymmetrical manner with respect thereto. This can take place, for 25 example, by milling off a circular-section-like part of the hemispherical shell and of the corresponding part of the insert. This enables the device according to the invention to be used in the direct vicinity of a chamfer or of a radius.

30

#### BRIEF DESCRIPTION OF THE DRAWINGS

A preferred embodiment of the invention is described in detail with reference to the attached 35 drawing, in which:

Fig. 1 shows an exploded, lateral sectional view of a preferred embodiment of the device according to the invention,  
40      Fig. 2 shows a lateral sectional view of the device according to Fig. 1 in the assembled state, and  
Fig. 3 shows a lateral sectional view of a further embodiment of the device according to the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Fig. 1 illustrates the individual components of  
5 the device according to the invention in detail, and Fig.  
2 illustrates them in the assembled state.

A spike 1 can be passed by means of its upper  
part 1a, which is designed with a screw thread, through  
a central passage in an insert 4 of an attachment element  
10 2 and can be screwed to an internal thread 13 provided on  
the inside of an outer shell 3 of the attachment element  
2. The insert 4 can be arranged and fixed in this case in  
15 a precisely fitting manner in the shell 3, as can be seen  
in particular in Fig. 2. In this case, the lower edge 3a  
15 of the shell 3 bears flush against the lower side 4a of  
the insert 4. The edge 3a which is of bevelled or  
chamfered design ensures that the attachment element 2  
can be positioned in a simple manner or can be removed  
from a component surface by hand.

20 The spike 1 is customarily manufactured from a  
metallic material. The shell 3 is produced from a  
non-magnetic material, for example aluminium, and the  
insert 4 from a magnetic material. It would be  
conceivable also to produce the shell 3 from a magnetic  
25 material. Furthermore, the components 3, 4 could be  
designed as a single piece.

On account of the magnetic properties of the  
insert 4, the attachment element 2 can be fastened in a  
simple and secure manner to a body part, for example to  
30 a floor panel 5, as illustrated in Fig. 3. In this case,  
the spike 1 which is arranged in the attachment element  
2 is inserted into a hole formed in the floor panel 5, so  
that the lower side 4a of the insert can rest flat on the  
floor panel 5. Magnetic forces between the insert 4 and  
35 floor panel 5 ensure that the attachment element 2 can  
also be fastened to the lower side of the floor panel 5  
in a simple manner, as illustrated.

A partially spherical surface or hemispherical  
surface as is provided by the surface of the shell 3, can  
40 be measured in a simple manner which is known per se  
(customarily using 5 scanning procedures), so that the  
central point of hole, into which the spike 1 which is in  
operative connection with the shell 3 is inserted, can be

determined. By virtue of the fact that one attachment element 2 can be used in an adapter-like manner for a multiplicity of spikes 1, the measuring and adjustment outlay for measuring, for example, a body which has holes 5 of differing size into which different spikes 1 in each case have to be inserted, is substantially reduced. The use of the device according to the invention means that it is no longer necessary to measure and to report on a multiplicity of different attachment elements.

10 Fig. 3 additionally illustrates how, in accordance with a particular refinement of the attachment element 2, measurement of holes to which access is difficult in the vicinity of an edge 5a is possible. By milling of a circular-section-shaped part of the 15 attachment element 2, positioning of a hole formed in the direct vicinity of the edge 5a is possible in a simple manner. Since a sufficiently large spherical surface is, as before, provided by the shell 3, measuring or determining the position of the hole in which the spike 20 1 is positioned can also be carried out here.

When the device according to the invention is used, a hole which is to be measured can readily be removed up to approximately 5 mm from its desired position without necessitating an interruption because of 25 a collision to a CNC series measuring sequence during the measuring of the attachment element. The method for measuring a spherical surface is always identical, so that the surface and/or the characteristic data of the attachment element 2 can always be reflected (reused) in 30 the programming, thereby rendering repeated measurement of the spherical surface superfluous.

[27841/WO/1]

[DaimlerChrysler AG]  
[Stuttgart]

5 [Device for determining the position of or for measuring  
a hole] DEVICE FOR DETERMINING THE POSITION OR SIZE OF A  
HOLE

BACKGROUND AND SUMMARY OF THE INVENTION

10

The present invention relates to a device for determining the position of or for measuring a hole [in accordance with the preamble of Patent Claim 1], and to an attachment element [in accordance with the preamble of Patent Claim 6].

15

In numerous technical applications it is necessary, in order to measure a component, to determine the precise positions of or distances between a number of holes formed in the component. For example, in the sphere of using measuring techniques to check body shells and also subgroups thereof, for example sheet-metal add-on parts or else individual parts, measurements of this type have to be carried out frequently. A difficulty here is that the holes or the central points thereof are not accessible directly and so precise measurements turn out to be very complicated. Furthermore, the dimensions of holes are frequently affected by tolerances and so it is expedient to determine the central points of holes.

20

DE-C 936895 discloses a device for measuring distances on an object, which device is inserted into a hole in the object to be measured. The device consists of two separate parts, namely a shank for fitting into the hole in the object, and a part which ends in a ball of a certain radius of curvature. This ball can be positioned in such a manner that it serves as reference point with respect to the central point of the hole. A disadvantage of this device is that it is not possible to use this device to undertake a measurement at inaccessible locations, for example on a floor panel of a motor vehicle body, since the device does not have any means for fixing it so as to undertake precise measurements in the hole to be measured.

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DE-C 733 370 discloses a means for measuring distances of connecting points, in particular points which cannot be measured directly, such as ball centres, the said means consisting of a main measuring rod having 5 longitudinally adjustable sliding bodies and measuring elements which can be displaced therein transversely to the main measuring rod. This means which is of comparatively large construction is not suitable for undertaking measurements at inaccessible locations.

10 German utility model G 91 06 101 discloses a precision measuring rod which, by inserting a spike into an opening, permits the diameter of the opening to be measured. The precise determination of the position of the opening is not the subject matter of the teaching 15 described in this publication.

The object of the invention is the provision of a device with which a determination of the position of or measurement of inaccessible holes or recesses in a component is possible in a simple manner.

20 [This object is achieved by means of a device having the features of Patent Claim 1 and also by means of an attachment element having the features of Patent Claim 6.]

The invention provides a device with which the 25 precise determination of the position of holes or recesses, for example in a body of a motor vehicle, can be carried out in a simple manner. The formation of at least part of the attachment element from a magnetic material enables the device according to the invention to 30 be simply and reliably fixed on a component, which facilitates the carrying-out of very precise measurements. Measurements can also be carried out without any problem at inaccessible locations, for example the floor panel of a motor vehicle body, since 35 the device according to the invention can be inserted, for example from below, into a hole in the floor panel and can be fixed in the inserted position without further auxiliary means. The device according to the invention can be produced very reasonably. A particular advantage 40 is the mounting of at least one attachment element together with a multiplicity of spikes in a jig. In this case, all of the spikes required for measuring a body

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together with an attachment element which can be used with all of the spikes can be provided in an easily surveyed manner.

Of course, protection is sought for the  
5 attachment element which can be used in such a manner like an adapter and into which spikes of any design can be inserted.

[Advantageous refinements of the invention are the subject matter of the subclaims.]

10 According to a preferred refinement of the device according to the invention, the attachment element has an essentially hemispherical or partially spherical shell made of a non-magnetic material, and an insert arranged within the shell and made of a magnetic material. At the  
15 insert use can be made, for example, of a conventional magnetic flat gripper which can be fixed in a simple and positionally precise manner in a shell made, for example, of aluminium.

20 The spike can expediently be screwed to the attachment element. This firstly makes precise positioning of the spike in the attachment element possible, but secondly also enables the two parts to be detached from one another in an uncomplicated manner, with the result that one attachment element can be used  
25 for a multiplicity of spikes.

According to a preferred refinement of the device according to the invention, the spike has an upper part which is designed with a screw thread, can be passed through the insert and can be screwed to the inside of  
30 the shell. This enables the insert to first of all be positioned and/or fixed in a precisely fitting manner in the shell, as a result of which the attachment part composed in such a manner can be used in an adapter-like manner together with a multiplicity of spikes.

35 According to a further preferred refinement of the device according to the invention, the spike can be fastened to the attachment element in an asymmetrical manner with respect thereto. This can take place, for example, by milling off a circular-section-like part of  
40 the hemispherical shell and of the corresponding part of the insert. This enables the device according to the

invention to be used in the direct vicinity of a chamfer or of a radius.

#### BRIEF DESCRIPTION OF THE DRAWINGS

5

A preferred embodiment of the invention is described in detail with reference to the attached drawing, in which:

10 Fig. 1 shows an exploded, lateral sectional view of a preferred embodiment of the device according to the invention,

Fig. 2 shows a lateral sectional view of the device according to Fig. 1 in the assembled state, and

15 Fig. 3 shows a lateral sectional view of a further embodiment of the device according to the invention.

#### DESCRIPTION OF THE PREFERRED EMBODIMENTS

20 Fig. 1 illustrates the individual components of the device according to the invention in detail, and Fig. 2 illustrates them in the assembled state.

25 A spike 1 can be passed by means of its upper part 1a, which is designed with a screw thread, through a central passage in an insert 4 of an attachment element 2 and can be screwed to an internal thread 13 provided on the inside of an outer shell 3 of the attachment element 2. The insert 4 can be arranged and fixed in this case in a precisely fitting manner in the shell 3, as can be seen 30 in particular in Fig. 2. In this case, the lower edge 3a of the shell 3 bears flush against the lower side 4a of the insert 4. The edge 3a which is of bevelled or chamfered design ensures that the attachment element 2 can be positioned in a simple manner or can be removed 35 from a component surface by hand.

40 The spike 1 is customarily manufactured from a metallic material. The shell 3 is produced from a non-magnetic material, for example aluminium, and the insert 4 from a magnetic material. It would be conceivable also to produce the shell 3 from a magnetic material. Furthermore, the components 3, 4 could be designed as a single piece.

On account of the magnetic properties of the insert 4, the attachment element 2 can be fastened in a simple and secure manner to a body part, for example to a floor panel 5, as illustrated in Fig. 3. In this case, 5 the spike 1 which is arranged in the attachment element 2 is inserted into a hole formed in the floor panel 5, so that the lower side 4a of the insert can rest flat on the floor panel 5. Magnetic forces between the insert 4 and floor panel 5 ensure that the attachment element 2 can 10 also be fastened to the lower side of the floor panel 5 in a simple manner, as illustrated.

A partially spherical surface or hemispherical surface as is provided by the surface of the shell 3, can be measured in a simple manner which is known per se 15 (customarily using 5 scanning procedures), so that the central point of hole, into which the spike 1 which is in operative connection with the shell 3 is inserted, can be determined. By virtue of the fact that one attachment element 2 can be used in an adapter-like manner for a 20 multiplicity of spikes 1, the measuring and adjustment outlay for measuring, for example, a body which has holes of differing size into which different spikes 1 in each case have to be inserted, is substantially reduced. The use of the device according to the invention means that 25 it is no longer necessary to measure and to report on a multiplicity of different attachment elements.

Fig. 3 additionally illustrates how, in accordance with a particular refinement of the attachment element 2, measurement of holes to which access is 30 difficult in the vicinity of an edge 5a is possible. By milling of a circular-section-shaped part of the attachment element 2, positioning of a hole formed in the direct vicinity of the edge 5a is possible in a simple manner. Since a sufficiently large spherical surface is, 35 as before, provided by the shell 3, measuring or determining the position of the hole in which the spike 1 is positioned can also be carried out here.

When the device according to the invention is used, a hole which is to be measured can readily be 40 removed up to approximately 5 mm from its desired position without necessitating an interruption because of a collision to a CNC series measuring sequence during the

measuring of the attachment element. The method for measuring a spherical surface is always identical, so that the surface and/or the characteristic data of the attachment element 2 can always be reflected (reused) in 5 the programming, thereby rendering repeated measurement of the spherical surface superfluous.

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Device for determining the position of or for measuring  
a hole

10 The present invention relates to a device for determining the position of or for measuring a hole in accordance with the preamble of Patent Claim 1, and to an attachment element in accordance with the preamble of Patent Claim 6.

15 In numerous technical applications it is necessary, in order to measure a component, to determine the precise positions of or distances between a number of holes formed in the component. For example, in the sphere of using measuring techniques to check body shells and also subgroups thereof, for example 20 sheet-metal add-on parts or else individual parts, measurements of this type have to be carried out frequently. A difficulty here is that the holes or the central points thereof are not accessible directly and so precise measurements turn out to be very 25 complicated. Furthermore, the dimensions of holes are frequently affected by tolerances and so it is expedient to determine the central points of holes.

30 DE-C 936895 discloses a device for measuring distances on an object, which device is inserted into a hole in the object to be measured. The device consists of two separate parts, namely a shank for fitting into the hole in the object, and a part which ends in a ball of a certain radius of curvature. This ball can be positioned in such a manner that it serves as reference 35 point with respect to the central point of the hole. A disadvantage of this device is that it is not possible to use this device to undertake a measurement at inaccessible locations, for example on a floor panel of

a motor vehicle body, since the device does not have any means for fixing it so as to undertake precise measurements in the hole to be measured.

DE-C 733 370 discloses a means for measuring 5 distances of connecting points, in particular points which cannot be measured directly, such as ball centres, the said means consisting of a main measuring rod having longitudinally adjustable sliding bodies and measuring elements which can be displaced therein 10 transversely to the main measuring rod. This means which is of comparatively large construction is not suitable for undertaking measurements at inaccessible locations.

German utility model G 91 06 101 discloses a 15 precision measuring rod which, by inserting a spike into an opening, permits the diameter of the opening to be measured. The precise determination of the position of the opening is not the subject matter of the teaching described in this publication.

20 The object of the invention is the provision of a device with which a determination of the position of or measurement of inaccessible holes or recesses in a component is possible in a simple manner.

This object is achieved by means of a device 25 having the features of Patent Claim 1 and also by means of an attachment element having the features of Patent Claim 6.

The invention provides a device with which the 30 precise determination of the position of holes or recesses, for example in a body of a motor vehicle, can be carried out in a simple manner. The formation of at least part of the attachment element from a magnetic material enables the device according to the invention to be simply and reliably fixed on a component, which 35 facilitates the carrying-out of very precise measurements. Measurements can also be carried out without any problem at inaccessible locations, for example the floor panel of a motor vehicle body, since the device according to the invention can be inserted,

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for example from below, into a hole in the floor panel and can be fixed in the inserted position without further auxiliary means. The device according to the invention can be produced very reasonably. A particular 5 advantage is the mounting of at least one attachment element together with a multiplicity of spikes in a jig. In this case, all of the spikes required for measuring a body together with an attachment element which can be used with all of the spikes can be 10 provided in an easily surveyed manner.

Of course, protection is sought for the attachment element which can be used in such a manner like an adapter and into which spikes of any design can be inserted.

15 Advantageous refinements of the invention are the subject matter of the subclaims.

According to a preferred refinement of the device according to the invention, the attachment element has an essentially hemispherical or partially 20 spherical shell made of a non-magnetic material, and an insert arranged within the shell and made of a magnetic material. At the insert use can be made, for example, of a conventional magnetic flat gripper which can be fixed in a simple and positionally precise manner in a 25 shell made, for example, of aluminium.

The spike can expediently be screwed to the attachment element. This firstly makes precise 30 positioning of the spike in the attachment element possible, but secondly also enables the two parts to be detached from one another in an uncomplicated manner, with the result that one attachment element can be used for a multiplicity of spikes.

According to a preferred refinement of the device according to the invention, the spike has an 35 upper part which is designed with a screw thread, can be passed through the insert and can be screwed to the inside of the shell. This enables the insert to first of all be positioned and/or fixed in a precisely fitting manner in the shell, as a result of which the

attachment part composed in such a manner can be used in an adapter-like manner together with a multiplicity of spikes.

According to a further preferred refinement of 5 the device according to the invention, the spike can be fastened to the attachment element in an asymmetrical manner with respect thereto. This can take place, for example, by milling off a circular-section-like part of the hemispherical shell and of the corresponding part 10 of the insert. This enables the device according to the invention to be used in the direct vicinity of a chamfer or of a radius.

A preferred embodiment of the invention is described in detail with reference to the attached 15 drawing, in which:

Fig. 1 shows an exploded, lateral sectional view of a preferred embodiment of the device according to the invention,

Fig. 2 shows a lateral sectional view of the device 20 according to Fig. 1 in the assembled state, and

Fig. 3 shows a lateral sectional view of a further embodiment of the device according to the invention.

Fig. 1 illustrates the individual components of 25 the device according to the invention in detail, and Fig. 2 illustrates them in the assembled state.

A spike 1 can be passed by means of its upper part 1a, which is designed with a screw thread, through a central passage in an insert 4 of an attachment 30 element 2 and can be screwed to an internal thread 13 provided on the inside of an outer shell 3 of the attachment element 2. The insert 4 can be arranged and fixed in this case in a precisely fitting manner in the shell 3, as can be seen in particular in Fig. 2. In 35 this case, the lower edge 3a of the shell 3 bears flush against the lower side 4a of the insert 4. The edge 3a which is of bevelled or chamfered design ensures that the attachment element 2 can be positioned in a simple manner or can be removed from a component surface by

hand.

The spike 1 is customarily manufactured from a metallic material. The shell 3 is produced from a non-magnetic material, for example aluminium, and the 5 insert 4 from a magnetic material. It would be conceivable also to produce the shell 3 from a magnetic material. Furthermore, the components 3, 4 could be designed as a single piece.

On account of the magnetic properties of the 10 insert 4, the attachment element 2 can be fastened in a simple and secure manner to a body part, for example to a floor panel 5, as illustrated in Fig. 3. In this case, the spike 1 which is arranged in the attachment element 2 is inserted into a hole formed in the floor 15 panel 5, so that the lower side 4a of the insert can rest flat on the floor panel 5. Magnetic forces between the insert 4 and floor panel 5 ensure that the attachment element 2 can also be fastened to the lower side of the floor panel 5 in a simple manner, as 20 illustrated.

A partially spherical surface or hemispherical surface as is provided by the surface of the shell 3, can be measured in a simple manner which is known per se (customarily using 5 scanning procedures), so that 25 the central point of hole, into which the spike 1 which is in operative connection with the shell 3 is inserted, can be determined. By virtue of the fact that one attachment element 2 can be used in an adapter-like manner for a multiplicity of spikes 1, the measuring 30 and adjustment outlay for measuring, for example, a body which has holes of differing size into which different spikes 1 in each case have to be inserted, is substantially reduced. The use of the device according to the invention means that it is no longer necessary 35 to measure and to report on a multiplicity of different attachment elements.

Fig. 3 additionally illustrates how, in accordance with a particular refinement of the attachment element 2, measurement of holes to which

access is difficult in the vicinity of an edge 5a is possible. By milling of a circular-section-shaped part of the attachment element 2, positioning of a hole formed in the direct vicinity of the edge 5a is possible in a simple manner. Since a sufficiently large spherical surface is, as before, provided by the shell 3, measuring or determining the position of the hole in which the spike 1 is positioned can also be carried out here.

10 When the device according to the invention is used, a hole which is to be measured can readily be removed up to approximately 5 mm from its desired position without necessitating an interruption because of a collision to a CNC series measuring sequence  
15 during the measuring of the attachment element. The method for measuring a spherical surface is always identical, so that the surface and/or the characteristic data of the attachment element 2 can always be reflected (reused) in the programming,  
20 thereby rendering repeated measurement of the spherical surface superfluous.

Year	Population	Area (sq. miles)	Population per square mile
1850	1,000,000	100,000	10
1860	2,000,000	100,000	20
1870	3,000,000	100,000	30
1880	4,000,000	100,000	40
1890	5,000,000	100,000	50
1900	6,000,000	100,000	60
1910	7,000,000	100,000	70
1920	8,000,000	100,000	80
1930	9,000,000	100,000	90
1940	10,000,000	100,000	100
1950	11,000,000	100,000	110
1960	12,000,000	100,000	120
1970	13,000,000	100,000	130
1980	14,000,000	100,000	140
1990	15,000,000	100,000	150
2000	16,000,000	100,000	160
2010	17,000,000	100,000	170
2020	18,000,000	100,000	180

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Patent Claims

1. Device for determining the position of or for measuring a hole in a component, in particular a body part of a motor vehicle, having a spike (1) for fitting into the hole, and an attachment element (2) which can be connected releasably to the spike (1) and, with the spike (1) fitted into the hole, rests on the component surface surrounding the hole, characterized in that at least part of the attachment element (2) is produced from a magnetic material.

2. Device according to Claim 1, characterized in that the attachment element (2) has an essentially hemispherical or partially spherical shell (3) made of a non-magnetic material and an insert (4) arranged within the shell (3) and made of magnetic material.

3. Device according to Claim 2, characterized in that the spike (1) can be screwed to the attachment element (2).

4. Device according to Claim 3, characterized in that the spike (1) has an upper part (1a) which is designed with a screw thread, can be passed through the insert (4) and can be screwed to the inside of the shell (3).

5. Device according to one of the preceding claims, characterized in that the spike (1) can be fastened to the attachment element (2) in an asymmetrical manner with respect thereto.

6. Attachment element for a device for determining the position of or for measuring a hole, having means for the releasable connection to a spike (1) which can be fitted into the hole, characterized in that at least part of the said element is produced from a magnetic material.

7. Attachment element according to Claim 6,  
characterized in that it has an essentially  
hemispherical or partially spherical shell (3) made of  
a non-magnetic material and an insert (4) arranged  
5 within the shell (3) and made of a magnetic material.

ABSTRACT OF THE DISCLOSURE

A device for determining the position of or for measuring a hole in a component, in particular a body part of a motor vehicle, has a spike for fitting into the hole, and an attachment element which can be connected releasably to the spike. With the spike fitted into the hole, the attachment element rests on the component surface surrounding the hole. At least part of the attachment element is produced from a magnetic material.

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Abstract

Device for determining the position of or for measuring a hole in a component, in particular a body part of a motor vehicle, having a spike for fitting into the hole, and an attachment element which can be connected releasably to the spike and, with the spike fitted into the hole, rests on the component surface surrounding the hole, at least part of the attachment element being produced from a magnetic material.

Fig. 1

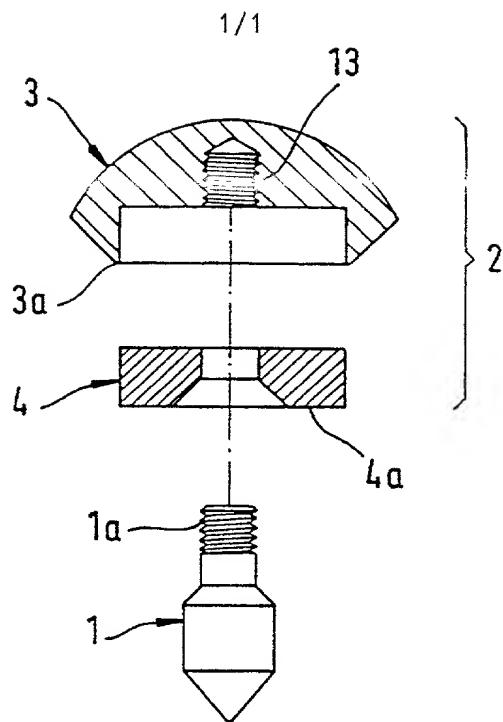


Fig. 2

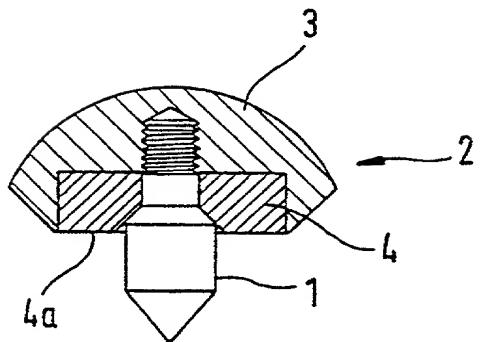
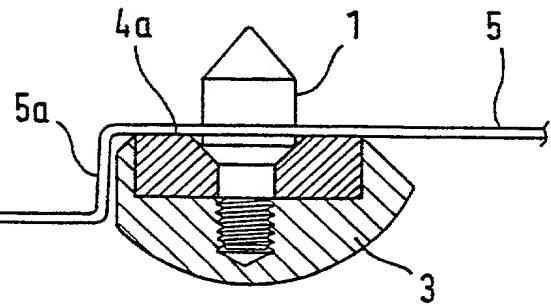


Fig. 3



COMBINED DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY  
(includes Reference to PCT International Applications)

ATTORNEY'S DOCKET  
NUMBER  
225/49355

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

DEVICE FOR DETERMINING THE POSITION OR SIZE OF A HOLE

the specification of which (check only one item below):

is attached hereto.

was filed as United States application  
Serial No \_\_\_\_\_  
on \_\_\_\_\_  
and was amended  
on \_\_\_\_\_ (if applicable).

was filed as PCT international application  
Number PCT/EP99/02989  
on 3 May 1999  
and was amended under PCT Article 19  
on \_\_\_\_\_ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations. §1 56(a).

I hereby claim foreign priority benefits under Title 35, United State Code, §119 of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed.

PRIOR FOREIGN/PCT APPLICATION(S) AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. 119:

COUNTRY (if PCT indicate PCT)	APPLICATION NUMBER	DATE OF FILING (day, month, year)	PRIORITY CLAIMED UNDER 35 USC 119
Germany <input checked="" type="checkbox"/>	198 20 340.3 <input checked="" type="checkbox"/>	7 May 1998 <input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
			<input type="checkbox"/> Yes <input type="checkbox"/> No
			<input type="checkbox"/> Yes <input type="checkbox"/> No
			<input type="checkbox"/> Yes <input type="checkbox"/> No
			<input type="checkbox"/> Yes <input type="checkbox"/> No



23911

PATENT TRADEMARK OFFICE

Combined Declaration For Patent Application and Power of Attorney (Continued)  
(includes Reference to PCT international Applications)

ATTORNEY'S DOCKET NUMBER  
225/49355

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) or PCT international application(s) designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application(s) and the national of PCT international filing date of this application:

PRIOR U.S. APPLICATIONS OR PCT INTERNATIONAL APPLICATIONS DESIGNATING THE U.S. FOR BENEFIT  
UNDER 35 U.S.C. 120

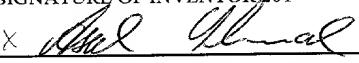
U.S. APPLICATIONS		STATUS (Check one)		
U.S. APPLICATION NUMBER	U.S. FILING DATE	PATENTED	PENDING	ABANDONED
PCT APPLICATIONS DESIGNATING THE U.S.				
PCT APPLICATION NO	PCT FILING DATE	U.S. SERIAL NUMBERS ASSIGNED (IF ANY)		

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (List name and registration number)

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Evenson, McKeown, Edwards & Lenahan, P.L.L.C. 1200 G Street, N.W., Suite 700 Washington, D.C. 20005			(202) 628-8800
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	RESIDENCE & CITIZENSHIP	CITY <u>Böblingen</u>	STATE OR FOREIGN COUNTRY Germany <u>OEX</u>
202	POST OFFICE ADDRESS	POST OFFICE ADDRESS Amsterdamer Strasse 24, D-71034	CITY Böblingen
	FULL NAME OF INVENTOR	FAMILY NAME	FIRST GIVEN NAME
203	RESIDENCE & CITIZENSHIP	CITY	STATE OR FOREIGN COUNTRY
	POST OFFICE ADDRESS	POST OFFICE ADDRESS	CITY

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

SIGNATURE OF INVENTOR 201	SIGNATURE OF INVENTOR 202	SIGNATURE OF INVENTOR 203
		
DATE <u>2000-11-13</u>	Date	DATE